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March-April 1952

METAL TREATING

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METAL TREATING INSTITUTE

JOURNAL OF THE METAL TREATING INSTITUTE

National Trade Association of

COMMERCIAL HEAT TREATERS

(Above) The plant of MTI member, Commercial Steel Treating Corporation, Detroit, Michigan, is one of the largest commercial operations in the country.

(Left) Efficient lay-out and completeness of equipment for every type of metal treating operation is revealed by this scale model of the production facilities of the Commercial Steel Treating Corporation. This scaled model was designed for use in planning the reorganization of floor space for maximum production and overall efficiency in operation.

Don't buy heat treating equipment blindfolded! Results obtained on sample batches of your products in this spic and span Ajax Metallurgical Service Laboratory can be duplicated in your own plant.

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ON HEAT TREATING RESULTS AND COSTS!

Without charge or obligation, the Ajax Metallurgical Service Laboratory will treat specimen parts by any of the following processes:

CARBURIZING
CYANIDE HARDENING
NEUTRAL HARDENING
ANNEALING OR HARDENING STAINLESS STEEL
BRAZING
HARDENING HIGH SPEED STEEL
AUSTEMPERING
MARTEMPERING
PROCESS ANNEALING
CYCLIC ANNEALING
SOLUTION HEAT TREATMENT
DRAWING (Tempering)
DESCALING, CLEANING
DESANDING

What about the quality of the finished work? Will it be scale-free, devoid of decarb? Will the heat treatment prevent distortion and thereby reduce or eliminate costly grinding or finish machining operations? How much production will the furnace give per hour, and what floor space will be needed? What will the power, labor, maintenance and other heat treating costs amount to? *In short, will your proposed new furnace live up to the manufacturer's enthusiastic claims for it?*

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1—No Ajax salt bath furnace is ever sold until Ajax engineers—backed with experience in over 3,000 installations—are convinced it will do the job to your entire satisfaction *as well as to theirs.*

2—Before buying, we strongly urge that you utilize the facilities of the full commercial scale Ajax Metallurgical Service Laboratory. Send or bring batch lots of your materials for heat treating under actual working conditions. Let us prove beyond any question of doubt what can be done, how it can be done, and under exactly what conditions.

3—Once your furnace is installed, an Ajax engineer will visit your plant to double check, to instruct, and to make sure that on-the-job operation fully matches your expectations.

This policy has resulted in the most outstanding patronage ever accorded any heat treating furnace, both in the importance and number of users. A list of users is available on request. The high percentage of customers who have re-ordered Ajax heat treating equipment is unparalleled in the furnace industry.

AJAX ELECTRIC COMPANY, Inc.

World's Largest Manufacturer of Electric Heat Treating Furnaces Exclusively

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AJAX HULTGREN **ELECTRIC SALT BATH FURNACES**

Editorial...

HELP DIG OUT THE SCRAP

There's still urgent need to increase the flow of scrap metal from all possible sources.

Scrap metal can come from any plant using machinery, from any firm making or processing metal products, and from many companies which may believe they have none.

For instance: A shirtmaker finds 98 tons around his main plant; a small button works scraps 20 tons of obsolete machinery; a metropolitan bus line rounds up 200 tons in its shop; a paper company intensifies its annual scrap drive and collects 125% more tonnage than in the previous year; a dairy uncovers about 150 tons of scrap.

In short, wherever there is business there is scrap. That scrap may be "production scrap" or "dormant scrap." It's the dormant scrap, which does not flow to mills normally, that's so badly needed today. Dormant scrap is found wherever obsolescence, wear, accident, damage or other cause has brought retirement from active service of products containing steel, iron, copper, brass, bronze, aluminum, lead and zinc. For example, there may be in your plant obsolete machinery, tools, jigs, dies, fixtures and other equipment, including items broken, worn beyond repair, abandoned, dismantled or in need of replacement parts no longer obtainable.

The main job is to get the dormant scrap out. And the following basic instructions, if followed by *every* business, can assure success of the expanded recovery program:

1. *Go after dormant scrap* — Start an emergency inspection and inventory of all heavy steel, whether machines, equipment, beams or plates. Dispose of everything you possibly can to a scrap dealer.
2. *Delegate authority* — The top executive of every industrial and commercial establishment, large and small, should appoint someone with authority to act in cleaning out dormant scrap.
3. *Appoint a salvage committee* — In large industrial firms the chief executive should insure complete coverage by appointing a salvage committee with authority to determine what is scrap and to order its disposal. The committee should:
   a. Search all plants and properties, regardless of size, for dormant scrap;
   b. Survey potential wrecking and dismantling projects that will produce scrap;
   c. Make disposition of all production and dormant scrap as quickly as possible.
4. *Put scrap collection on a "housekeeping" basis* — Make it the personal responsibility of some one to initiate a program to clean out the dormant scrap and to make a scrap survey every 90 days. Besides increasing the dormant scrap, continuous scrap recovery from questionable old stand-bys, obsolete machines and equipment reduces taxes through inventory write-off, improved safety conditions, gives lowered insurance rates and clears valuable space.

The heat treating industry, and all plants operating heat treating departments produce scrap. It will pay off if you dig it out.

METAL TREATING

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The Lindberg Mechanized Batch Type Furnace For Controlled Atmosphere Heat Treating

By N. K. KOEBEL, *Director of Research*
Lindberg Engineering Company

EDITOR'S NOTE: This issue of METAL TREATING presents the third and fourth descriptive articles of our symposium series on the subject of batch type heat treating furnaces. Users of these and the equipment described in the January-February issue are invited to send us articles or comments on their applications of this type of equipment.

The outstanding features of the Lindberg semi-automatic carbonitriding furnace are its high production capacity with minimum floor space, no pits required for installation or maintenance, low maintenance cost, uniformity of carbonitrided case with dense loads, high volume-high pressure oil quench system for extremely dense loads, and flexibility of the furnace for accommodating a great variety of parts requiring heat treating operations ranging from annealing, neutral hardening, carbon correction, light, medium, or heavy case hardening or carbonitriding.

The economy and advantages of the carbonitriding furnace over the salt bath method have been fully covered in the literature. One point that has not been stressed is the flexibility of the furnace for operations other than carbonitriding. A well designed semi-automatic batch type furnace cannot only be used to replace cyanide salt baths, but also can be used for medium and heavy straight carburizing at 1700°F, carbon correction, scale-free hardening of medium or high carbon steels, and atmosphere annealing operations. The automatic vertical quenching of the work in the alloy baskets not only eliminates costly individual handling of parts, i.e., stringing on wires or special fixtures, but also eliminates nicking and reduces distortion to a minimum. The balanced atmosphere in the furnace eliminates soot during the carbonitriding, carburizing or neutral hardening cycles, and the protective atmosphere which surrounds the work while being quenched eliminates scale and, therefore, any drastic and costly cleaning operation such as sand blasting. The above advantages and flexibility in operation coupled with the small floor area for the high production rate makes this type of furnace the outstanding profit-making machine in a commercial or industrial heat treating shop which has a high production made up of batches of a great variety of parts requiring different types of heat treatment.

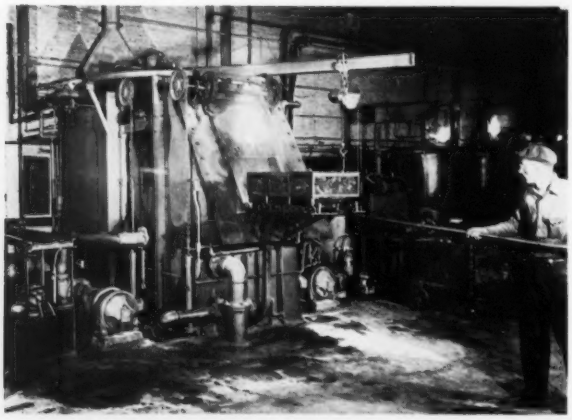

Fig. 1—Charging the Lindberg high production mechanized batch type furnace. The unit is designed for a minimum of floor space, and no pits are required.

The Lindberg high-production carbonitriding furnace, shown in Figs. 1 and 2, is of the in-and-out batch type in which the quench tank and purge chamber are located in front of the heating chamber. It is designed so that no pits are required and a minimum of floor space is needed. The furnace, including the quench chamber and all piping, requires a floor space of 7′ wide by 16′ long or 112 square feet. This unit is rated to produce 800 net pounds of neutral hardening and 500 to 600 net pounds of light case carbonitriding at 1550°F. Light case carbonitriding ranges from .005″ to .008″ case depth. Deep case carbonitriding or case carburizing reduces the production rate in pounds per hour depending on the time required for the depth of case desired.

The furnace proper is heated by six alloy, gas-fired radiant tubes of the hair-pin type extending through the rear wall so that all burners are accessible in that one location. The maximum input for all six tubes is 1,300,000 B.T.U. This is more than enough for the maximum rated output of the furnace, and this feature coupled with the large radiating surface engineered in the tube design makes it possible to operate the furnace with one tube out and thus prevent loss of production during the working days of the week for maintenance. Maintenance on tubes can be made over weekends while the furnace is idling.

A high-volume, high-pressure circulating blower for forced convection heating is mounted in the furnace arch to give active circulation of the hot gases through the charge in a defined path. The bearing of the blower is water cooled to reduce maintenance, and all maintenance is made easy by having the blower mounted from the top of the furnace where it is accessible and can be handled with a chain hoist. A high pressure type blower with a high volume output is essential to obtain uniform results with work that packs densely.

Rapid recuperation of temperature when a cold load is charged is made possible by the use of heat storing refractories. While the load of work is being

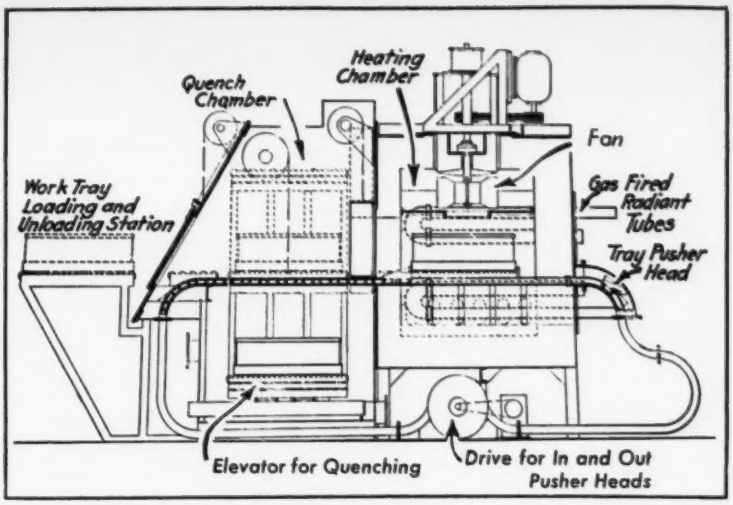

Fig. 2—Cross-section of the carbonitriding furnace as seen from the side. Work is pushed manually into the purge chamber and the balance of the cycle is automatic.

soaked out at temperature, heat is stored up in the dense refractory to be released to the next charge of cold work. This factor coupled with the high B.T.U. input, large area of radiating surface from the tubes, and the high volume-high pressure blower make it possible to achieve a high output in pounds per hour of work treated for a relatively small hearth area.

The furnace is designed to handle trays or fixtures 24" wide, 36" long, and 15" high or smaller baskets of the same total dimensions. It is arranged to quench the entire load in one operation and, hence, reduce overall cycle time. A double-deck quench rack is used so that a second load can be charged while the first is cooling in the quenching oil. This arrangement further reduces cycle time.

The quench tank is equipped with two externally mounted high volume-high pressure circulating pumps. Each pump is rated at 650 G.P.M. at a 45 foot head. Besides the above two pumps, a separate 75 G.P.M. pump is used to recirculate the oil through an externally mounted cooling system. The flow of oil is directed down through the work in the fixture or basket and assures full quenching of the densest loads. The use of high volume-high pressure pumps is essential to obtain maximum rated output of the furnace when steels of relatively low hardenability are neutral hardened. The above type of oil quench system also makes it possible to oil harden many steels that would normally require a water quench for production treatment. The flow of oil is directed downward to prevent the floating off and consequent loss of small parts in the quench tank.

Gravity rollers on the charge table and quench elevator simplify work handling. The work basket is pushed manually into the purge chamber, and the balance of the cycle is completed automatically. A non-continuous "snake" chain energized by a variable drive unit under the furnace pushes the loaded basket into the furnace; it then retracts so that no part of the chain remains in the furnace. When the heating cycle is completed, the chain drive reverses direction and pushes the load out onto the quench elevator; the chain retracts and the elevator then automatically lowers the work into the oil. Since the tray pusher-head pushes against a tray and does not have to engage into the tray or basket, successful operation of the charge and discharge mechanism is assured even though the trays become warped after considerable use. This lowers the repair and replacement of work fixtures or baskets.

Low maintenance and ease of maintenance has been the keynote in the design of the Lindberg high production, mechanical, batch type furnace. It should be understood that the maintenance problem is more acute in a furnace of this design, which has mechanized handling equipment, high speed, alloy fan, and alloy tubes operating in carburizing and nitriding atmospheres, than in the general run of heat treating furnaces. For this reason, too much attention cannot be given to the selection and proper use of materials, but also to locate all parts that are likely to fail in time in an accessible position so that down time is kept to a minimum. A survey on one of the above units has shown that the furnace and auxiliary equipment has been maintained for 2 years at a cost of 40 cents per operating hour. This includes maintenance and repair of baskets and fixtures, pan, oil pumps, radiant tubes, refractories, and electrical equipment. For a period of 14 months all maintenance was carried on while the furnace was either operating or idling over weekends. The low maintenance cost is due in large measure to the accessibility of radiant tubes, fan, oil pumps, and other components.

The Lindberg Engineering Company uses an external generator on all atmosphere heat treating furnaces. The main reason for this is to obtain precise control over the atmosphere for any heat treating operation whether it be carbonitriding, carburizing, neutral hardening, carbon correction, or annealing. High temperature cracking coupled with a precise mixing machine and carburetor is necessary to obtain complete reaction of the gas and flexibility of control for easy adjustment to any carbon content steel. Incom-

Typical parts heat treated in the Lindberg semi-automatic batch type furnace. These items were subjected to a carbonitriding treatment to secure depths of case from .005" to .015".

plete cracking at low temperatures promotes the danger of forming soot in the furnace. Sooted carbonitrided or carburized parts will not pickel or plate and, thus, the higher initial cost of a separate, precision controlled endothermic generator will soon pay for itself by eliminating rejects and costly tumbling or sand blasting operations. Besides the advantage of having complete control over the atmosphere for any heat treating operation, a separate, precision, endothermic generator lowers the maintenance cost and provides a central source of supply that can be tapped for other furnaces as the necessity arises.

The average composition of the atmosphere from the Lindberg HYEN endothermic generator is as follows:

0.0% oxygen, 0.0% carbon dioxide, 21% carbon monoxide, 40% hydrogen, 1.0% max. methane, and 38.0% nitrogen. The dew point (moisture content) of this gas is adjustable and will vary with the air-gas ratio. The dew point controls the carbon potential of the atmosphere and this can be set by the operator for any carbon content steel. The carbon potential of this atmosphere when used for carbonitriding is approximately 0.70% to 0.80%. The gas mixture for a hard case consists of 85% endothermic carrier gas, 10% anhydrous ammonia, and 5% natural gas. In the furnace described above, approximately 400 CFH of endothermic carrier gas is used. The cost of the endothermic carrier gas ranges from 18 to 25 cents per 1000 CFH.

In addition to the high production furnace described above, the Lindberg Engineering Company also produces a radiant tube furnace with a capacity of 250 net pounds per hour of light case carbonitriding. The mechanization of this furnace is exactly the same as the heavy production unit shown in Figs. 1 and 2, but the fan size, oil pumps, and amount of heat storing refractories are reduced because the production rate does not warrant a similar construction and the initial cost is kept at a minimum for the small shop.

An electric furnace, using a special 80 nickel-20 chromium heating element, rated at 250 net pounds per hour of light case is also available with the same mechanization. The electric furnaces are limited to 1600°F for carburizing gases. Five years experience in using the special electric element in carbonitriding atmospheres up to 1600°F has shown that an average of one year's life can be expected. This compares favorably with the life of gas fired radiant tubes, but the tube furnaces get a much more drastic work-out up to temperatures of 1700°F.

SYMPOSIUM SERIES NO. 4

'Allcase' High Production Batch Type Furnace

By R. J. Light, *Development Engineer*
Surface Combustion Corporation

'Surface' Allcase batch-type controlled atmosphere furnaces are proving highly versatile tools for production heat treating in capacities up to 900 lbs. per hour. Commercial and plant heat treat shops have found that this high production furnace is not only economical in operation but also highly flexible in application. Diverse work loads are efficiently handled and all controlled atmosphere treatments are possible, with or without liquid quenching, as required. Furnace is easy to operate and actually requires only one operator working part-time.

The wide range of possible process applications includes case and homogeneous carburizing, carbon restoration, dry cyaniding, clean hardening and bright annealing.

Production Rates

The Allcase furnace is built by Surface Combustion Corporation in two standard sizes. The larger size is

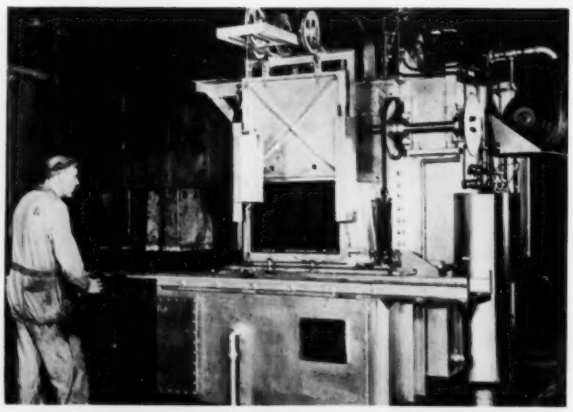

Fig. 1—Large size Allcase controlled atmosphere furnace in operation. Operator is using central control pulpit.

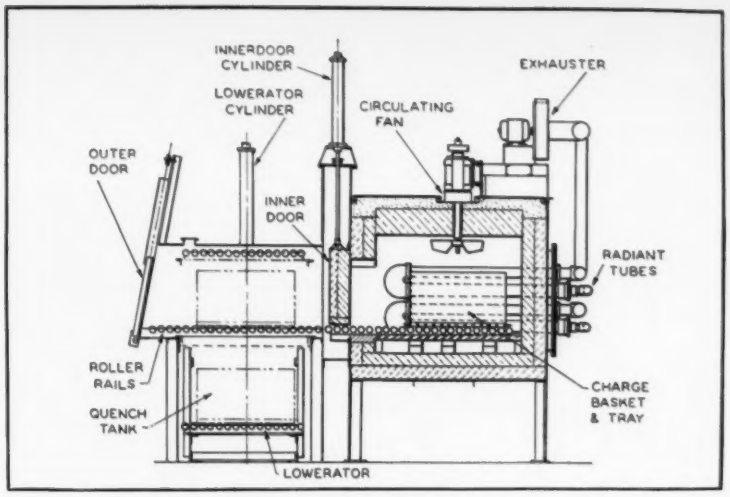

Fig. 2—Cross-section of small size Allcase furnace.

rated at up to 1600 lb./hr. gross and the smaller up to 500 lb./hr. gross. These capacities provide available heating rates as high as 200 lb./hr./sq.ft. of hearth area. Heating rate is determined by type of work and production requirements.

Design Features

Working Temperature Range—1400 to 1750°F; automatic control.

Heat Input—1,800,000 Btu/hr. for larger capacity furnace.
600,000 Btu/hr. for smaller capacity.

Burner Equipment—Radiant tubes with combination premix and diffusion type burners operating on gas or oil. Exhauster fan collects products of combustion. Tubes readily removable from rear of furnace.

Recirculation—Each furnace is equipped with a high-capacity alloy propeller-blade type fan. This recirculates hot gases uniformly from radiant tube surfaces, through the charge.

Oil Quenching—Tank of adequate size to accommodate full furnace charge at one time. Propeller type mixer creates constant agitation by forcing oil through work basket. Oil also cooled by recirculation. Entire quench assembly is above floor level—special pit is not required.

Operation

Furnace is charged with lowerator in "up" position and charge baskets are manually pushed into vestibule. After purging, they are manually pushed into heating chamber. On the larger Allcase furnace, the outer door is operated by air cylinder with foot pedal and inner door is controlled by speed-reducing motor. The smaller furnace has a manually-operated outer door and an air cylinder-actuated inner door.

Automatic control equipment regulates furnace temperature and also introduces prepared gas atmosphere when temperature reaches 1400°F.

Work load, in baskets on trays, is supported on alloy rails that extend the length of furnace hearth and also form platform of quench elevator. Atmosphere quenching is accomplished in the furnace vestibule by a lowerator mechanism. Baskets are lowered from the vestibule through a sealed-off chute extending below oil level. At this point, the methods of handling the trays of quenched work are adapted to the particular characteristics of the larger and smaller Allcase furnaces.

In the larger furnace, the two forward trays are pulled out onto the lowerator. The lowerator then descends into the quench; the trays are moved forward in the quench tank, off of the lowerator, which is then elevated into position for receiving the two rear trays. These are moved onto the lowerator and quenched in the oil while on the lowerator. After the work on these trays is quenched out, the lowerator returns to the "up" position, where the quenched work is removed. The furnace is then re-charged and the remaining pair of trays is subsequently removed from the quench tank.

The smaller furnace functions in a somewhat different manner. The load consists of two trays which are pulled out onto the lower set of roller rails of the lowerator. When the lowerator descends to the "quench" position with the trays, an upper set of roller rails comes into position to permit re-charging of the furnace. After the furnace has been re-charged, the lowerator is raised to the "up" position for removal of the quenched charge.

Both furnaces can be supplied with pushbutton control for the major operations.

Fig. 3—Some typical parts heat treated in this high production batch type furnace. Group at left was dry cyanided; at center, gas carburized; and at right, clean hardened.

Heat Treating Machines

Ingenious mechanical devices permit a great variety of heat treating operations, using flame heat.

By H. C. KNERR, *Metlab Co.*
Philadelphia, Pa.

Yale & Towne Mfg. Co. of Philadelphia, whose hoists, lift trucks, weighing scales and other products are simplifying problems of material handling in many of America's industrial plants, must make an immense variety of individual parts and pieces in the assembly of their diverse products. As these products, themselves, are undergoing a continual revision of design and function, their shop must preserve an exceedingly versatile character.

It is hardly necessary to point out to our readers that the production of materials-handling machinery, constantly subject to increasing loads and heavier service demands, calls for the utmost in metallurgical skill and in the processing of parts through heat treatment.

Often the solution of complex and difficult heat treating problems which may change from year to year, or even from day to day, makes heavy demands upon the resourcefulness and skill of those responsible. An outstanding example of ingenuity is found in the heat treating shop of the Yale & Towne Plant.

During a recent visit there, the writer was so impressed by various clever devices developed by their staff that he requested permission to present some of them to the readers of Metal Treating. Through Mr. William F. Sorenson, Chief Metallurgist, this permission was kindly extended and photographs, here reproduced, were supplied. Mr. Sorenson and Mr. Malcolm A. Field, Foreman of the Heat Treating Department, are responsible for the numerous ideas embodied in these devices and, what is perhaps even more difficult, making them work in a practical and economical manner.

Fig. 1 is a general view of a versatile machine capable of performing a wide variety of heat treating operations on small parts, and also such things as brazing, soldering, and the like.

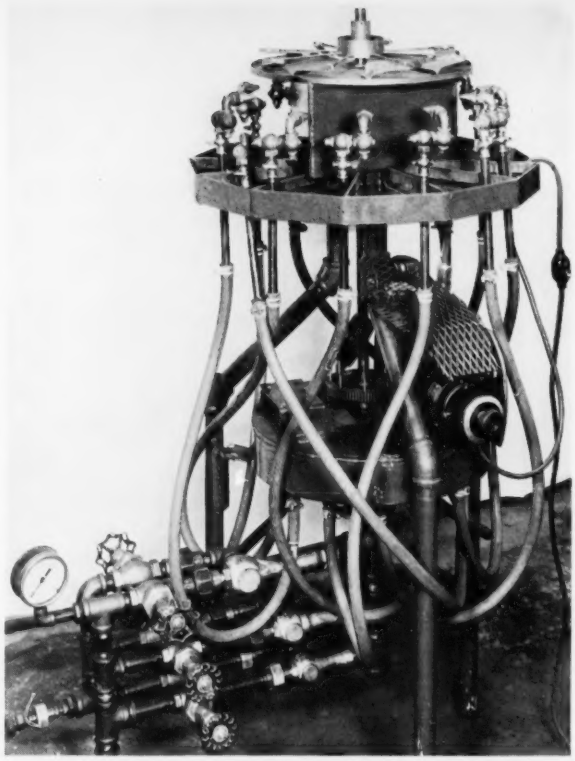

Fig. 1—A specially designed heat treating machine adaptable for performing a large number of heat treating operations, including brazing, soldering, etc.

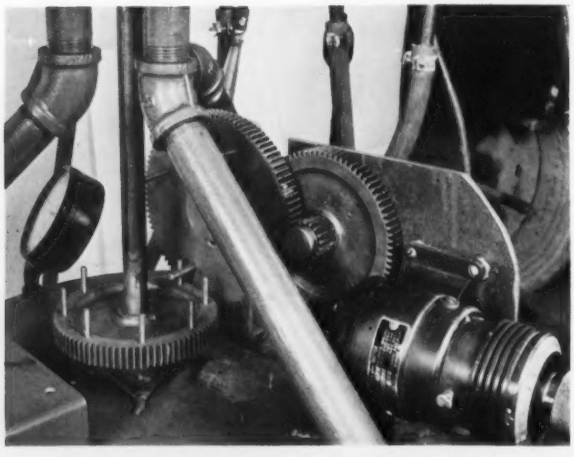

Fig. 2—Driving mechanism for the machine (Fig. 1).

The machine is mounted on a tripod of legs made from ordinary pipe. A platform midway up carries an electric motor whose speed can be varied by turning a knurled head. The motor is small enough to be plugged into a convenient socket, so that the machine may be placed at any desired spot.

The platform supports a set of gears, better seen in Fig. 2. The last gear in the train drives a vertical shaft which extends upward through the working platform and has various functions as will appear.

The gearing system not only helps to reduce speed from the rpm of the motor, but creates a controllable, intermittent motion. The bottom gear does not, in fact, mesh with the teeth of the drive gear, but is provided with a series of eight pins around its circumference. These engage with a similar series of pins in the last gear of the driving train, whose axis is horizontal. As each of the latter pins engages with one of the eight pins in the shaft gear, it causes a rotation of one-eighth turn in the vertical shaft, which then comes to rest until the next pin in the driving gear engages the next pin on the shaft gear. By varying the number of pins in the driving gear (from one to four), the interval of rest of the shaft, and therefore of the operating head, can be determined. Speeding or slowing down the driving motor increases or decreases the total time cycle.

The middle platform also acts as a mixer and manifold for the gas and compressed air system. Gas is supplied through the pipe at the lower lefthand corner of Fig. 1, and compressed air through the adjacent hose connection. Propane gas and air as desired are mixed in three venturis, each being fed with a pair of valves, thereby permitting three stages of gas volume. This avoids difficulties due to excessive turndown in any one venturi. An acetylene torch can also be used for heat treating several jobs on this machine.

The mixed gases are collected and passed upward into the bottom of the manifold chamber, which in turn has a series of nipples extending from the bottom, each of which connects with a hose feeding a burner on the upper platform.

Radial members in the latter permit mounting and adjustment of these burners at any desired position or location. Each burner is provided an individual valve and any number from one up may be used.

One use of the operating head is shown in Fig. 3. Here, the vertical shaft is fitted with a collar having eight radially extended bars. These bars sweep over a fixed circular platform. Small parts to be heated are laid upon this platform and are guided along its rim to a depression where two burners, firing in opposite directions, are mounted. The other burners in this view are inoperative.

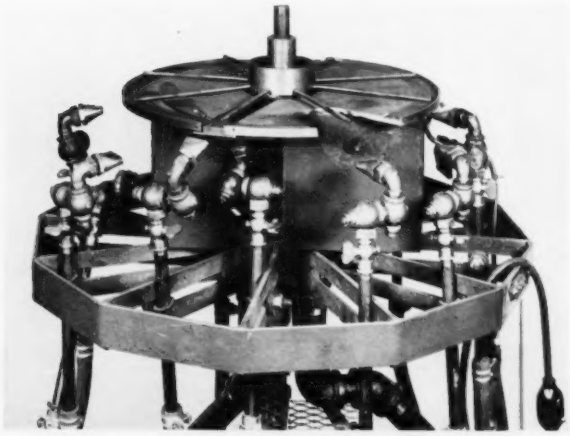

Fig. 3—The unit set up with an operating head platform for treating small parts. Note adjustability of burner angles.

The convenient arrangement for adjusting the burners by means of slots and eyebolts is clearly shown in this view.

As each of the eight arms brings its piece into position, the piece remains on the depressed location long enough for a burner to heat each of its ends. The rotation of the shaft is stopped by adjusting the pins in the gear system for a time long enough to accomplish the desired heating. Then the head proceeds to rotate again, removes the piece from the position of heating to the next station, where it falls through a cutaway into a receiving pan, not shown. Meanwhile, the next arm brings its piece into the heating position.

The particular purpose of this setup, not shown on the picture, was to soften the extreme ends of triangular knife edges used in weighing systems. These had to have an extremely sharp, hard edge, and there was a tendency for the corners to break off. A very slight bluing was sufficient to overcome this difficulty.

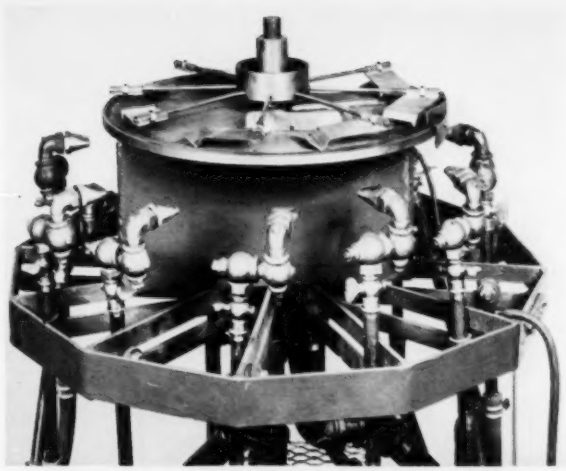

Fig. 4—Another modification using special work holding fixtures.

After being duly set up by the heat treating supervisor, a girl simply feeds the machine by placing one piece in front of each of the rotating arms. Output about sixty pieces a minute.

Fig. 4 shows a slight modification of this device, for pieces of special shape. Individual carrying arms designed to fit the contour of the piece and hold it in the desired position are slipped over the ends of the radial driving arms.

Fig. 5 shows the same machine set up for local hardening of small pins or thimbles. Here a stationary circular platform is set slightly below the water level in the quench tank, the latter being part of an old steel drum.

A rotating plate just above the water level has eight holes into which the small parts, such as a thimble

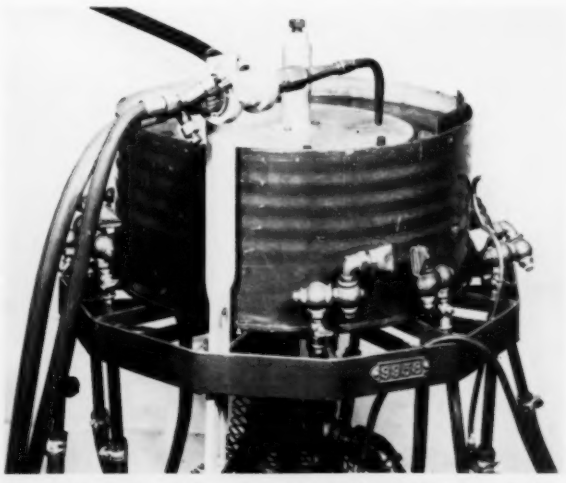

Fig. 5—The same machine set up for local hardening of small pins or thimbles.

shown, are set. Water level is controlled by an overflow pipe, not visible. A supply of cooling water enters through the hose at upper left corner.

A single burner is mounted on an extension arm. The rotating plate, driven by the vertical shaft, brings each piece under the burner and holds it for a time sufficient to permit heating the upper end. Then the rotating plate moves forward to the next position where there is a cutaway permitting the thimble to fall through and be quenched. At the same moment, the next thimble is brought in line under the burner.

The vertical drive shaft extends up through a pipe welded into the bottom of the quench tank, so that no stuffing box is required.

Fig. 6 illustrates how this same machine can be used to harden wheel rims or pulleys. The quench tank shown in Fig. 5 is replaced by an annular quenching fixture whose inside diameter is perforated. Water is fed to this ring through a large pipe at each side. The surrounding can is merely a catchall to take away the water. The vertical shaft is fitted with a special collar, not shown, upon which the wheel is carried. The drive gears are arranged to give continuous rotary motion, about forty rpm. The wheel to be quenched is first held at an elevation corresponding to that of the multiple, radially firing burners. When heated, a trigger, not shown, releases the carrying collar and allows the wheel to drop down within the quenching ring. After cooling, the wheel is removed by hand, the collar is reset, and a new wheel is put on.

Still another adaptation of this versatile device is illustrated in Fig. 7. Here it is used for flame brazing or soldering. A rotating head having eight holding fixtures adapted for the part is mounted on the shaft. The particular piece for which this fixture was designed consists of a flat rectangular bar upon which a cylindrical pin is mounted crosswise near one end, within a groove milled in the bar. It is necessary to hold the bar down, and to hold the transverse pin in position on the bar, with the ends extending equally on both sides. Expansion of the pin during heating requires the introduction of a self adjusting spring on the left hand lug of each fixture. Brazing material is applied. Rotation of the head in successive steps brings the assemblies into position before each of a series of burners, permitting stages of heating, until the final stage for brazing. Then after an interval of cooling, the assembled piece is removed. Naturally, this principle can be varied in many ways. Cooling water is supplied at a couple of places to remove excess heat from the fixture and facilitate cooling of the brazed part.

Here, Fig. 8, is shown an old lathe head fitted with a motor and speed reducer, the latter driving the lathe spindle through a sprocket and chain. The face plate of the lathe is adapted to receive bearing races to be flame hardened. The tool rest is employed to carry the burner and water quench jet. For the inside race, the flame plays on the outside circumference of the ring in the desired area. For the outside race the burner and jet are reversed so as to play on the inner surface. The water tank is a catchall to remove excess

(Continued on page 15)

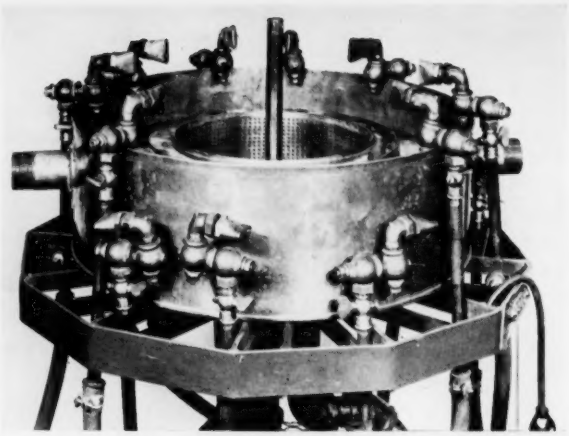

Fig. 6—Machine as used for hardening wheel rims or pulleys. Note spray quenching attachment.

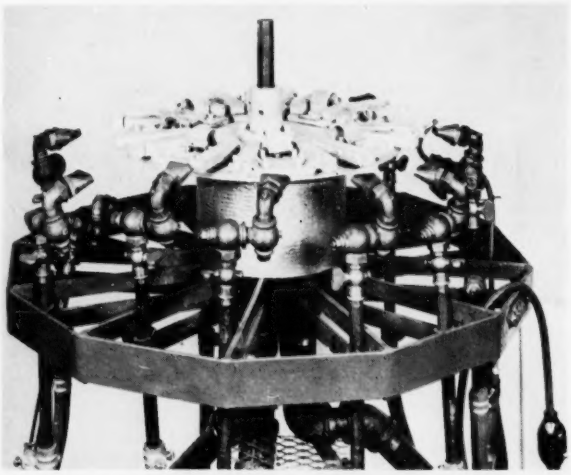

Fig. 7—Special brazing or soldering fixture designed for attachment to the unit.

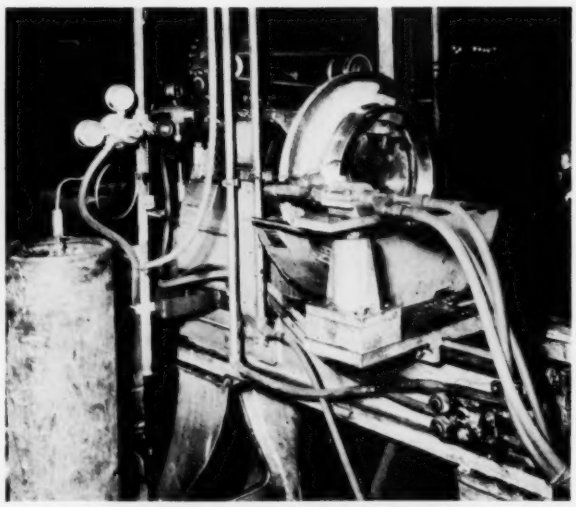

Fig. 8—A lathe head fitted with a motor and speed reducer so as to be used for flame hardening bearing races.

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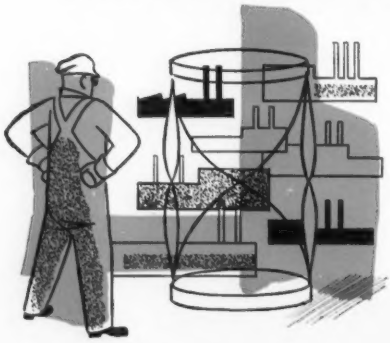
1. ***He offers under one roof complete service for all basic types of heat treating processes.***



2. ***His skills and equipment have been developed over years of meeting industry's needs.***

3. ***As an MTI member he is a leader in the field—known for quality—service—technical ability.***

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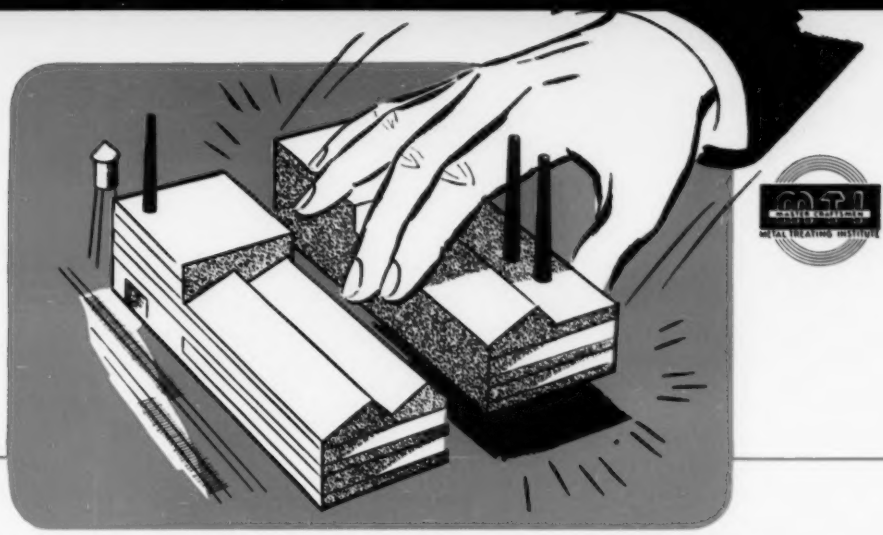

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Institute News . . .

1952 SPRING MEETING

As was announced in the January-February issue, the 1952 Spring Meeting of the Metal Treating Institute is set for the period from Wednesday, May 21 to Friday, May 23, at the Lake Placid Club, Lake Placid, N. Y.

The program has been set up to allow ample time for business and committee meetings plus the also important periods for fun, relaxation and good fellowship. The detailed program is given below:

PROGRAM—METAL TREATING INSTITUTE
MAY 21-23, 1952
Lake Placid Club, Lake Placid, N. Y.

WEDNESDAY—May 21

Committee Meetings

10:00 A.M. — Cost Accounting
Fall Meeting
Lunch on Your Own
1:30 P.M. — Publication
3:00 P.M. — Heat Treating Units
5:00 P.M. — President's Reception—Golf House
Dinner on Your Own

* * *

THURSDAY—May 22

10:00 A.M. — Business Meeting and all Committee Reports
Lunch on Your Own
P.M. — Enjoy Yourself—On Your Own
Evening — Outdoor Steak Broil

* * *

FRIDAY—May 23

10:00 A.M. — Business Meeting
Technical Speakers
Lunch on Your Own
2:30 P.M. — Boat Excursion on Lake Placid
6:00 to ? — Cocktail Party and Special Buffet—Golf House

The Spring Meetings of the Institute are becoming as sizable and important as the Annual Meetings. Take advantage of this opportunity to work and play with your old friends and new ones. Make your reservations now!

APPRENTICESHIP STANDARDS APPROVED

The Apprenticeship and Executive Committee have been working actively on the formulation of Standards of Apprenticeship for the heat treating trade. These standards have now been established in their final form and have received the full approval of the U.S. Department of Labor, Bureau of Apprenticeship. Copies of these standards will be forwarded to all members of the Institute and their establishment and Government acceptance means that all Metal Treating Institute members can now proceed immediately to set up a definite individual Apprenticeship Program in their plants. Such an Apprenticeship Program in many instances will be a real aid in alleviating manpower shortages. Furthermore, from a long range viewpoint, an Apprenticeship Program can result in the development of valuable and permanent personnel.

NEW MEMBERS

The Metal Treating Institute is pleased to announce the addition to its membership of the following companies:

Hollywood Heat Treating Co.
1046 North Orange Drive
Los Angeles 38, California

Reliable Metallurgical Service, Inc.
3827 Lakeside Avenue
Cleveland 14, Ohio

We are sure these new members will prove a real asset to the Institute and also will benefit from their close association with the other leaders in their field.

CHAPTER MEETINGS

On January 25, there was a meeting of the Mid-West Chapter of the Metal Treating Institute held at the Kungsholm Restaurant in Chicago. Representatives of fifteen member companies were present and the group welcomed the admission of the Senecca Heat Treating Co., Batavia, Illinois, as a new member. President Rex and Executive Secretary Herington were present and Chairman Art Eklund called upon them for a brief report on the progress that is being made by the Institute in its various activities.

On February 27, the Metropolitan-New Jersey group held a meeting at the Essex House in Newark, N. J. Representatives of nine member companies were present. Chairman Don Knoch, after some brief comments, called on Executive Secretary Herington for a brief report and the group also discussed plans for the forthcoming Spring Meeting at the Lake Placid Club, Lake Placid, New York. Past President Fred Heinzelman, Jr. brought with him a specific heat treating problem which resulted in some interesting and lively discussion.

On February 29, another meeting of the Mid-West group was held and thirteen member companies were represented. Discussion included various activities of the local group and the national MTI, including the possibility of establishing a national or local clearing house for production facilities so that customers may be aided in locating sources of open production capacity. There were also a considerable exchange of ideas of heat treatment problems involving boron steels.

COMMITTEE APPOINTMENTS

President Walter Rex has announced the appointment of the Fall Meeting Committee to handle details of the Fall Meeting of the Institute which will be held in Philadelphia on October 17, 18, and 19. They are:

J. H. Bockrath, *Wiedemann Machine Co.*
Purdy Benedict, *Benedict-Miller, Inc.*
George S. Lorenz, *Lorenz & Son*
Philip Keidel, *Robert Wooler*
Albert Boecker, *The Drever Co.*
Fred Heinzelman, Sr., *Fred Heinzelman & Sons*

quenching water, and keep the head cool. This particular device, or modifications thereof, have been used by many other treaters.

A more unusual gadget is that shown in Fig. 9. Here a driving motor, speed selector and speed reducer are mounted on a welded stand. The extended shaft of the speed reducer is fitted with a chuck upon which the object to be flame hardened is mounted. In the illustrated case it is a base plate which may be any size up to seven or eight feet across. SAE 1050 steel is used, and gives a hardness of C 59 to 61. The machined area on the plate carries the weight of a rotating mechanism. A circular surface about one inch wide must be hardened. This is done, as clearly shown, by a burner and quench nozzle operating horizontally against the machined circular surface. The big tank, again, is a water catchall and at the same time holds down the temperature of the plate and moving parts. A bank of three acetylene tanks manifolded to the burner is shown. Oxygen is piped in from a separate source.

The inner and outer races whose hardening is illustrated in Fig. 8, presented a difficult assembly problem, which was solved as shown in Fig. 10. The inner and outer races are separated by a series of a hundred or more steel balls. The outer race has a groove or shoulder about .010 inches deep, behind which the balls must rest.

The balls are first placed in position in a conical holder, shown. The outer race is heated in an oil bath to 400°F., causing it to expand approximately .030 inches. It is then placed upon the cone, and the inner race is next laid in position. Upon cooling, the outer race shrinks enough to retain the balls within the .01 inch shoulder, and the entire bearing is thereby very securely locked together, yet free to rotate.

The instrument shown is an automatic temperature control for the oil bath at lower right, which has receptacles for heating several rings.

Many of our readers are familiar with the method of hardening gear teeth illustrated in Fig. 11. This is another one of Mr. Sorenson's practical solutions of tricky heat treating problems. He calls it "liquid flame hardening." Instead of using a flame, however, he mounts four gears on a spindle, as shown, lowers them into position in an Ajax salt bath, and causes them to rotate at a desired speed by means of the motor and speed reducer shown at the right of the picture. Molten salt clings to the teeth while rotating, keeping them free from oxidation and retaining heat. After a predetermined time, the spindle with its four gears is removed from the salt bath and quenched by lowering endwise into a tank of oil.

The equipment described in this article is representative of the ingenuity and open handed cooperation which has done so much to speed the development of many American industries. The fundamental object is always to utilize to maximum advantage knowledge and products and imagination so as to achieve, to the benefit of all, more goods of better quality at less cost.

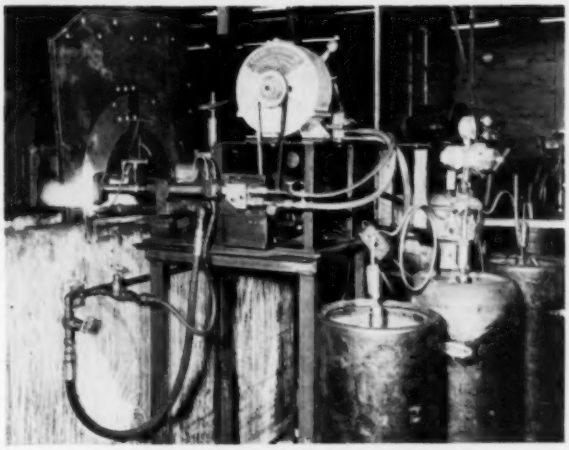

Fig. 9—Equipment used for hardening circular section 1" wide on a SAE 1050 steel base plate. Plates up to 8" wide may be accommodated by varying the burner.

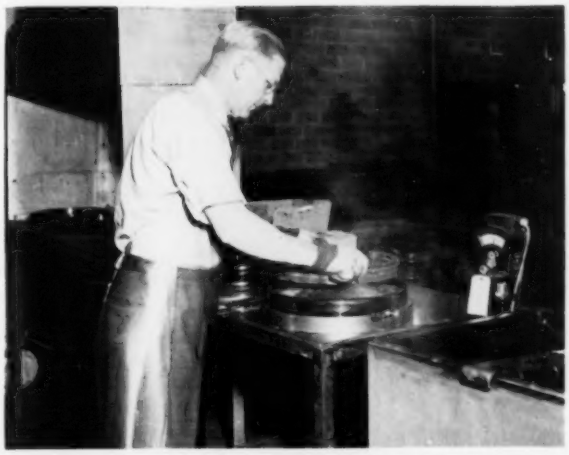

Fig. 10—Inventor Sorenson assembling bearings after the hardening treatment shown in Fig. 8. Outer bearing race is heated, then placed over cone containing balls. Cooling contraction locks assembly.

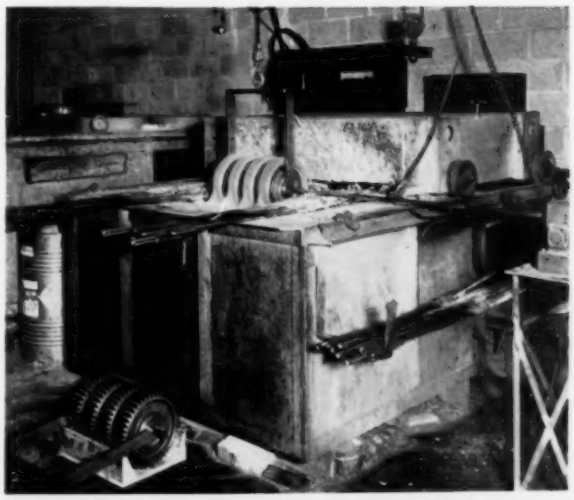

Fig. 11—"Liquid Flame Hardening" of gear teeth by spinning in molten salt bath.

Heat Treating Abstracts

The need for and value of heat treating was touched upon in at least three papers presented before the annual meeting of American Society of Tool Engineers in Chicago, Mar. 17 to 21, 1952.

It was said·

Boron steels which are being used to replace alloy steels can be hardened just as satisfactorily as the alloy grades. Acceptance of boron steels is based upon the now accepted theory that all steels, if heat treated properly to a given degree of hardness, exhibit the same mechanical properties. An unknown factor has been the ability to harden boron steels properly. This problem is now being overcome. Carburizing grades of boron steels can be successfully substituted if careful consideration is given to their peculiarities. In International Harvester, 77 per cent of medium-carbon steel has been changed over to boron steels.

(*From:* "Machining and Heat Treatment of Boron Steels", J. D. Graham, Metallurgist, Louisville Works, Intern'l Harvester Co.)

* * *

If a forming die wears out, it's too soft; if it breaks, it's too hard, and in either case, costs can be cut if the trouble is remedied. Die steel hardness can be adjusted to best advantage through heat treatment. To attain the desired degree of hardness in metal forming dies, extremely close control of temperature during heat treatment is necessary. Die wear is affected by the amount of carbon in the surface and it is recommended that this factor be controlled by methods that prevent loss of carbon from the die surface during heat treatment.

(*From:* "The Selection and Treatment of Die Materials", Dr. S. G. Graham, Chief Metallurgist, Latrobe Electric Steel Co.)

* * *

Metal parts that grow, shrink or distort with age decrease the accuracy that is built into modern precision tools. The only cure for the situation is the use of heat treatment to relieve stresses in component parts before they are machined. Consistent accuracy required of today's precision machines has led to the heating of some components to a constant temperature to avoid changes in dimensions resulting from changes in room and operating temperature.

(*From:* "Precision Hole Locating Methods", F. C. Victory, Chief Engineer, Moore Special Tool Co., Inc.)

Boron steels also came in for their share of attention at a recent SAE meeting.

Boron alloy steels should be selected on the basis of duplicating the minimum hardenability to a specified distance on the Jominy specimen, corresponding with the cooling speed of the critical section of the production part. It is not always necessary to duplicate the entire hardenability band. It is safer to calculate the minimum strength which will be obtained at the point of highest stress on the cross-section, on the basis of the minimum hardness which will be obtained at this point after a production quenching and drawing treatment, rather than on the basis of tensile specimens taken from the center, or half radius, positions.

Similarly, minimum physical properties representing the bottom of the expected hardenability band for the boron steel are more reliable than the most elaborate of service tests made upon parts manufactured from lots of steel representing the middle or upper portion of the hardenability band.

(*From:* "Hardenability as the Criterion for Selecting Boron Steels", H. B. Knowlton, Supervisor of Materials Engineering, International Harvester Co.)

NEW SLIDE CHART MAKES HEAT TREATING EASIER

Enables you to find at a glance this heat treating information on Carpenter Matched Tool and Die Steels:

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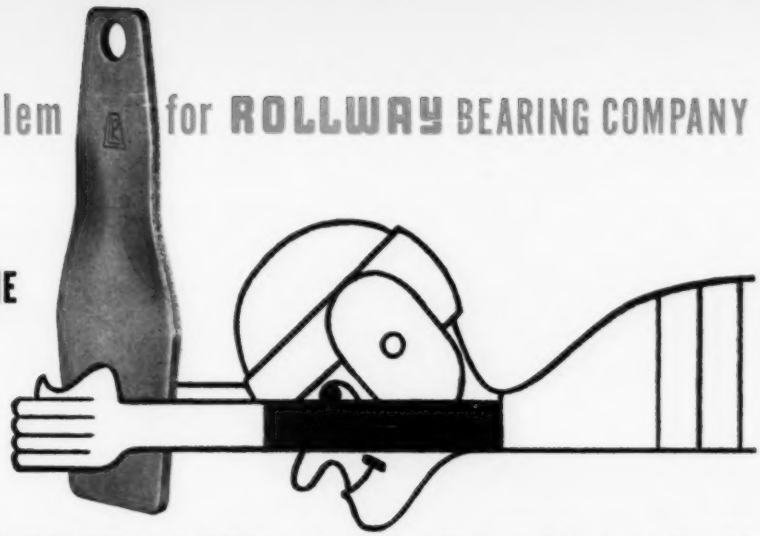

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Distortion of clutch levers and roller bearing thrust plates treated in a conveyor type furnace was causing a high rejection rate at Rollway Bearing Company. Rollway engineers felt the process could be improved and called in a Cyanamid Technical Representative who recommended a change to AEROHEAT 1200 salt baths.

Ends of these clutch levers, hardness 40-46 Rockwell C, are held parallel to within .001".

The clutch lever, SAE 1050-1066, was treated at 1550°F. in AEROHEAT 1200, oil quenched, then tempered at 625°F. for two hours. To meet specifications, the ends of the plate had to be parallel within .001" in the plane of the face. The recommended treatment reduced distortion and cut the reject rate from 40% to 5%.

The roller bearing thrust plate, SAE 52100 or its modification, was heat treated at 1525-1550°F. in AEROHEAT 1200, oil quenched, then tempered at 385-400°F. for 20-25 hours. With a maximum distortion of .010" permissible, average distortion has been .005-.006" since using AEROHEAT 1200. Uniform heating was secured, and heating time cut by 20%.

Here is another example of how Cyanamid technical service and heat treating compounds help you meet high specifications for civilian and defense contracts, so...

Next time call Cyanamid first...

These roller bearing thrust plates, hardness 60 Rockwell C, since treating with AEROHEAT 1200, have an average distortion of only .005-.006".

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HEAT TREATING HINTS

HOT QUENCHING PREVENTS RUPTURE IN HEAT TREATING

Austempering and martempering have been successful heat treating procedures for a great many production applications. Technical discussions and papers have gone to great lengths in presenting the advantages of these methods in relation to physical properties, distortion limitations, rupture and economies, in comparison to the conventional methods of heat treatment.

Unfortunately, the general impression seems to be that these procedures are applicable only as production methods. The advantages of hot quenching, a term more readily accepted by the operators in our plant, can be just as important on single parts as they have been in production runs. In a commercial heat treating plant the use of the hot quenching technique might mean the difference between success or failure in hardening a part of difficult shape.

Fig. 1

Figure 1 shows a part made of oil hardening tool steel used in the soap industry to cut soap flakes. The thin blades and heavy back-up area both require a minimum Rockwell of C57. The articles were made without consulting the heat treater as to risk involved during heat treating this type of steel or possible design change to minimize failure. Investigation, however, proved that the design could not be altered and also that any change in material would be of very little help in reducing chances of failure during heat treatment.

A cross-section of the part, shown in Figure 2, illustrates the extreme difference in section between the solid portion of the roll and the circular cutting fins. It would be difficult to imagine a design more likely to crack in hardening.

Fortunately the steel company supplying the tool steel had T.T.T. curves for the material supplied and they proved very helpful in planning the heat treat cycle. As in all cases where thin and heavy sections are involved, careful preheating of the part was a necessary precaution. To insure against thermal shock during heating the part was preheated as follows:

Preheat	280°F	hold	2 hrs.
"	400°F	"	1 hr.
"	600°F	"	1 hr.
"	800°F	"	¾ hr.
"	900°F	"	½ hr.
"	1200°F	"	½ hr.
Heat to	1460°F	"	½ hr.

After the soaking at 1460°F, the part was quenched in an agitated molten salt bath at 550°F and held for

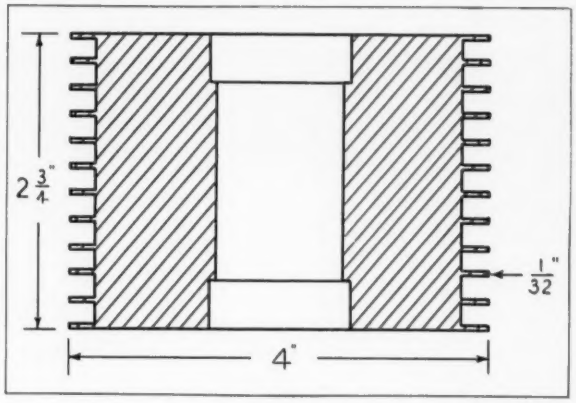


Fig. 2—Designed to crack in hardening, but can't be changed.

½ hr. at temperature. After air cooling from this temperature the resultant Rockwell showed a uniform hardness of 57-58 on all surfaces. The part was tempered 400°F for three hours with no drop in hardness.

There are many cases in heat treating where a similar application of the T.T.T. curves can reduce or eliminate the risk of failure during heat treatment.

FRED HEINZELMAN, JR., *Fred Heinzelman & Sons*

A QUESTION:

A good customer of ours occasionally uses C.S.M. 2 die steel for plastic molds. The molds come to us to be carburized and hardened. Experience has proved to us that the best temperature for casing is 1650°F. Most customers request quite deep cases, 1/16 to 3/32 is most usually specified.

Our problem is what to charge? Let's take a recent case of four punches total weight approximate 12 lb. Our records show that we used a box-type tool furnace 30" x 36" gas fired. Total carburizing time was 32 hours. This means that the furnace was tied up with this customer's work for the above stated time plus the extras of reheating and hardening after carburizing and the double draw operation. A total of 40 hours' furnace time was used.

The question is, can we charge $3.00 per hour, the rated furnace charge, making a cost of $120.00 for 12 lb. of work, or what do we do with a case of this kind? Should we advise the customer against the use of this special brand of tool steel or is there a better, shorter and cheaper heat treat cycle that can be used.

What would you do?

C. F. GRAHAM, *Metal Treating, Inc.*

AN ANSWER:

As 1650° to 1700°F is a good range for best results with all ordinary pack carburizing work, make this regular practice and accumulate enough work to insure a paying furnace load—parts requiring lighter case can be removed sooner.

H. C. KNERR, *Metlab Co.*

HOW TO AVOID THREE COMMON HEADACHES

(1) Many tool parts are damaged and possibly scrapped during the heat treating process because they were indiscretionally stamped before they were received by the heat treater. Deep stamping on a tool part is a cause of cracking due to the stresses developed from the sharp corner notch effects set up by heavy stamping. It is often suggested that tools, if they must be stamped, should be stamped very lightly. *The heat treater should stress relieve all parts that are stamped before heat treating.* This is usually done by heating to 1150°F and air cooling to at least 150°F.

(2) Occasionally in tool making, either for economy or repair purposes, it may be necessary to weld a section on or in a tool. Many times the welded section is machined or ground over, and the fact that it is welded cannot be determined by the heat treater. This is a very dangerous situation, because most of these parts will crack during heat treatment. *All parts made from tool steel that are welded should be properly annealed after welding and before heat treating.*

(3) An age old problem to the heat treater is the customers' failure to furnish sufficient information and sometimes his carelessness in furnishing improper information. The customer can protect his investment by simply giving the heat treating department a little information; namely, the type of material and the trade name, the hardness specifications, the working portion of the part and the maximum warpage allowable. Designating the type of material is not enough because different steel manufacturers use different analysis requiring different heat treatments. By knowing the section or portion of the part that must be hard it is often possible to avoid cracking or warpage by varying the heating and/or quenching procedure. *Get the facts about the material from the customer.*

STEWART DEPOY, *Dayton Forge & Heat Treating Co.*

"RADIATORS FOR COOLING"

We have a series of quench tanks about 4 feet square, 3 feet deep, containing oil, brine, caustic solution, and so forth, for quenching small parts. The output of several salt bath furnaces may be quenched in any one of these tanks. Therefore, the heat input may be rather high.

Originally, the tanks were double wall, having a water jacket with continuous circulation. They overheated.

Then we put in coils. Copper coils deteriorated rapidly due to the presence of cyanide in the carryover. Steel pipe coils were expensive to make and persistently leaked.

So then we went to a local scrap yard and bought ourselves a quantity of small, compact, cast iron radiator sections. These we hooked up to the recirculating water. There are two sets of three sections in each tank—one set on each side.

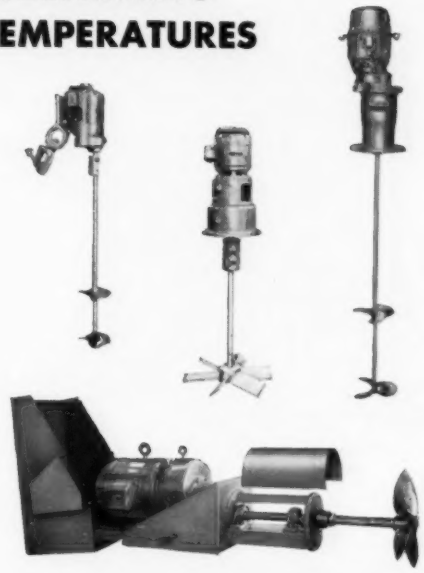
The tanks have always been provided with a motor driven agitator, as shown. This is essential, not only to get adequate flow over the work, but also to bring fresh oil up from the bottom of the tank, displacing

(Continued on page 21)

DEVINE AGITATORS

ASSURE

UNIFORM QUENCHING TEMPERATURES



- Provide proper circulation of quenching liquid.
- Help equalize quenching strains.
- Compact. Self-contained. No piping required.
- Unusually sturdy. Built for plenty of use.
- Easy to install. Easy to detach. Easy to maintain.

Devine Engineers will be glad to recommend a type and size to fit your tank.

J. P. DEVINE MFG. CO.

A. M. Cox, President

49th St. and AVRR · Pittsburgh 1, Pa.

Devine AGITATORS

NEW TRIPLE ACTION QUENCH OIL

★ FASTER, DEEP HARDENING

★ LESS DISTORTION

★ BRIGHT QUENCHING

★ GREATER STABILITY

PARK TRIPLE A QUENCH OIL

1.	Cools work rapidly in high temperature ranges
2.	Removes heat slowly, uniformly in low temperature ranges
3.	Minimizes temperature differentials within your work
4.	Lessens danger of warping and cracking

Looking for a FASTER, deeper hardening super quench oil? One that combines high cooling rates with extreme stability and the capacity to maintain its quenching power over long periods of time? Need an oil that will quickly develop maximum physical properties of a steel without danger of distortion or breakage? Then you'll do well to get the facts on Park TRIPLE A. It's a new "accelerated" type quenching oil developed expressly to cool steel faster in the upper temperature ranges. In quenching action, its vapor stage is short, its boiling stage intense. Then its final stage of cooling is slow and uniform to give your work best surface hardness and depth of hardness penetration without danger of warping or cracking. Extremely stable . . . not subject to breakdown, saponification or rancidity. Suitable for use as a quench from any heat treating medium. Highly recommended for obtaining maximum hardenability from low and medium alloy steels. Anti-oxidant added for *bright quenching* from carbo-nitriding process.

Send for descriptive Bulletin No. F8.

Park
CHEMICAL COMPANY
8076 Military
Detroit 4, Mich.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

LICENSED MANUFACTURER: Electric Resistance Furnace Co., Ltd., Weybridge, Surrey, England

BARGAINS

A purchasing agent once decided his firm was paying too much for lead pencils. Accordingly, he wrote far and wide asking for prices and samples in lots of 200 gross—enough to last for several years.

One of his letters went to Japan. The Jap pencil maker had dealt with price buyers before. He knew how to deal with this one. He sent him a beautiful sample pencil and an extremely low quotation on 200 gross "per sample."

The P.A. lost no time. The order was rushed post haste before the Japanese manufacturer might have time to change his mind or correct the error in case one had been made. When the pencils arrived, the P.A. rubbed his hands approvingly. They wrote beautifully, just as the sample had done. Not until he went to sharpen one did he find that each of the pencils contained only an inch or so of lead. The rest was hollow.

Indignation welled within him. He wrote a burning cable of protest to which the crafty Jap replied collect: "Honored sir, you have no complaint to make. The sample, too, was hollow."

And thus another buyer learned a lesson so well expressed years ago by Josiah Wedgewood—"*All things bear a price in direct proportion to the scale, time and expense attending their manufacture.* Those called dear are, when justly considered, the cheapest. . . ."

This holds just as true of pencils as it does of mousetraps, furnaces—or just about anything that anyone ever produces or anyone ever buys.

—Tips & Trends

LETTERS TO THE EDITOR

Dear Editor:

We have been interested to read one number of your Journal: "METAL TREATING".

Is it possible for you to send us regularly this magazine?

M. BOURDARIAT
Forges et Aciéries de Bonpertuis
Bonpertuis, France

• • •

Dear Editor:

I have just seen a copy of your November-December, 1951 issue of *Metal Treating* and would like to have copies regularly.

Will you please advise me in regard to either membership in the Institute or is there a regular subscription rate for this publication?

D. G. CLARK
Manager, Steel Sales
Firth Sterling Steel & Carbide Corp.
Pittsburgh 30, Pa.

• • •

Dear Editor:

Thank you for the editions of Metal Treating. I find the information very interesting and helpful. Please continue to send it.

C. E. RIGBY
Tool Hardener
Moraine Prod. Div. G.M.C.
Dayton, Ohio

• • •

Dear Editor:

Thank you for first copy of "Metal Treating". Find it very interesting and up to date, as to ideas and equipment used.

HENRY S. MAGDZICK
Heat Treater

• • •

Dear Editor:

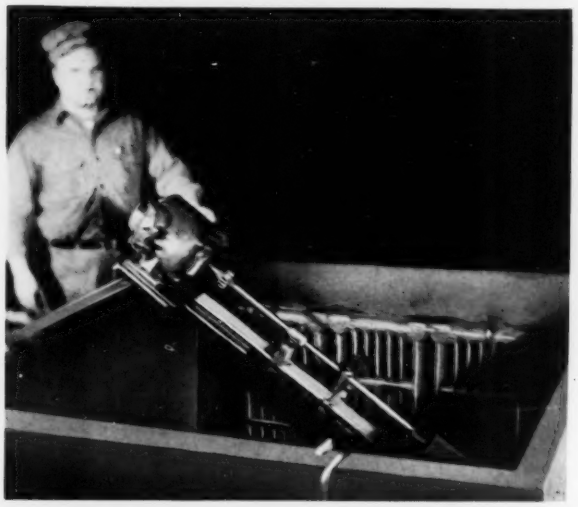
I am a research metallurgist at the above organization, directly concerned with development and improvement of assorted heat treating processes.

I have found your publication "Metal Treating" to be both educational and informative and would appreciate being placed on your mailing list.

GEORGE J. SNYDER
Watertown Arsenal
Watertown 72, Massachusetts

the hot oil at the top, and, of course, getting a good flow of oil around the radiator cooling surfaces.

The cast iron radiators have now been in service



about a year, with never a sign of leaking, overheating of the bath, or other serious trouble. The cost of the installation was very moderate.

CONRAD H. KNERR, *Metallurgical Laboratories Inc.*

HEAT TREATING SALTS — A WARNING

This is a reminder of something every heat treater is supposed to know.

Cyanide, and the carburizing salts containing cyanide, are deadly poison. They should be handled with great care, kept covered, not left around indiscriminately, and under no circumstances allowed to come in contact with food, lunch, or in any way taken internally. A very small amount of cyanide causes death. This is immediate, and there is no antidote.

Nitrate salts are explosive when mixed with carbonaceous materials or cyanide. No basket or fixture which has been used in one of these salts should ever be used with the other. Even careful washing may fail to remove traces which could cause an explosion. Keep cyanide and nitrates separate at all times.

Nitrates, if allowed to flow out upon wood or oil, will cause a bad fire, difficult to extinguish. Dry sand should be available in case of accident. Foamite is the last resort.

Neutral salts are relatively harmless, although, of course, they can set fire to wood or oil due to their heat.

Moisture. It is extremely important not to let any moisture get into a molten salt bath, either from dripping, rain from the roof, splashing from a quench tank, and so forth. Never spit into a salt bath.

H. C. KNERR, *Metlab Co.*

UPTON

offers

THE MOST ADVANCED SALT BATH FURNACES FOR

BATCH TYPE WORK	CONVEYORIZED TYPE WORK

WHY NOT GET THE BEST?

UPTON ELECTRIC FURNACE COMPANY

16806 HAMILTON AVENUE, DETROIT, MICH.

ERNEST F. ELLIOTT — SALES MANAGER **PHONE DIAMOND 1-2520**

News to Heat Treaters...

Morris Evans Leeds, founder and chairman of the board of Leeds & Northrup Company.

Morris E. Leeds, founder of Leeds & Northrup Co., Philadelphia, who died on February 8, 1952, was a man to whom the metallurgical industries owe a very substantial debt.

Mr. Leeds invented the potentiometer pyrometer for industrial use. This general type of instrument brought an entirely new order of precision and dependability to the job of temperature measurements. The first such instrument went to Midvale Steel Company in the Fall of 1911 and Mr. Leeds spearheaded the improvements in this device which were made over the next many years. A few years later, about 1915, Mr. Leeds encouraged his associates to develop the Hump Method for hardening. Old timers will remember that this was the first production equipment for detecting the critical in carbon steel by means of the Hump on the recorder chart. Its effect on increased tube life and improved treatment of gears, etc. for automobiles between 1916 and 1925 was very great.

Leeds & Northrup Company has recently shown that it still carries on Mr. Leeds' ideas by its announcement of the Microcarb Method for controlling carbon content of steel during the carburizing process.

As a very young business man Mr. Leeds adopted the age old beliefs that "business exists for man and not man for business" and that "the individual is entitled to receive the equivalent of what he produces." As long ago as 1916 Leeds & Northrup Company had a Cooperative Association to which everybody on the payroll belonged. Its function is to provide organized and semi-automatic means of contact, not only from management down the line but from the newest employee up the line. Although modified as a result of the Wagner Act this association remains a vital organization which recognizes the idea "we are all in business together".

Mr. Leeds pioneered a Profit Sharing Plan which now includes all persons on the payroll for more than one year. He initiated an unemployment plan in 1923. He was very active in initiation of sick relief and hospitalization plans and in his company's pension set up.

Family, friends, and industrial America have suffered a keen loss.

Hampel and Modjeska Form Chemical Consulting Firm

The formation of Hampel-Modjeska Laboratories was announced in a joint personal statement by Clifford A. Hampel, formerly supervisor of extraction metallurgy at Armour Research Foundation, and R. Scott Modjeska, founder and director of Scientific Control Laboratories of Chicago, Illinois.

The new organization will conduct research and development studies, technological and economic evaluations, and consulting work for industry and government in the fields of industrial chemicals, electrochemical and electrometallurgical processes and products, and the recovery and utilization of strategic metals.

Until new quarters are available, the Hampel-Modjeska Laboratories will use the facilities of the Scientific Control Laboratories, 600 S. Blue Island Avenue, Chicago, Illinois.

A. Rasmussen and R. Kroc Move Up at The Fahralloy Co., Harvey, Ill.

On the eve of the 20th anniversary of The Fahralloy Co., Harvey, Ill., A. Rasmussen, former Sales Manager, becomes Vice-President and Plant Manager and Robert E. Kroc, former Assistant Sales Manager, becomes Sales Manager.

Mr. Kroc has had broad experience in the design, production and marketing of chromium-nickel and stainless steel castings which the company produces at its Harvey, Ill. foundries. Canadian affiliate is at Orillia, Ontario.

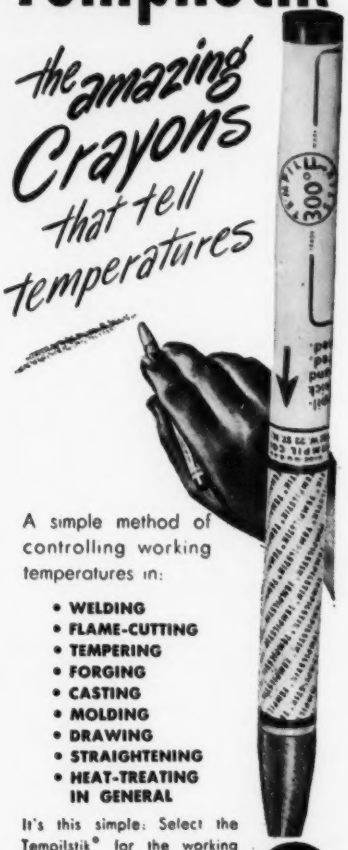
Fahralloy produces heat and corrosion resistant parts for heat treating furnaces and furnace builders, cement mills, refineries, and the process industries.

Robert E. Kroc, recently appointed Sales Manager of The Fahralloy Co., Harvey, Ill.

A. Rasmussen, recently elected Vice-President and Plant Manager of The Fahralloy Co., Harvey, Ill.

Tempilstik®

the amazing Crayons that tell temperatures



A simple method of controlling working temperatures in:

- **WELDING**
- **FLAME-CUTTING**
- **TEMPERING**
- **FORGING**
- **CASTING**
- **MOLDING**
- **DRAWING**
- **STRAIGHTENING**
- **HEAT-TREATING IN GENERAL**

It's this simple: Select the Tempilstik® for the working temperature you want. Mark your workpiece with it. When the Tempilstik® mark melts, the specified temperature has been reached.

$2 each

gives up to 2000 readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

Also available in pellet or liquid form.

FREE —**Tempil® "Basic Guide to Ferrous Metallurgy"** — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

METAL & THERMIT CORPORATION

100 EAST 42nd STREET
NEW YORK 17, N. Y.

How Long Oh Lord How Long!

Here are comparisons of the wordage in some rather famous pieces of writing.

	Words
The Ten Commandments	297
The Lord's Prayer	56
The Declaration of Independence	300
The Gettysburg Address	266
OPS Ceiling Order for Cabbage	26,911

—Materials & Methods

FOR SALE

1 — Leeds & Northrup Home Electric Furnace, accommodates baskets 22" in diameter by 26" deep, 50 KW, 220 Volts, 60 cycle, 3 phase, 1400° capacity complete with two stainless steel baskets, and Leeds & Northup Micromax recording instruments with panel board. This furnace used 1 day and guaranteed to be in new condition; priced at 50% of new cost.

THE COX MACHINE TOOL COMPANY
1010 S. Industrial Blvd.
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If you sell materials, parts, finishes or materials processing equipment, it pays to concentrate your advertising in Materials & Methods. More than 20,000 materials men—paid subscribers —*concentrate* on M & M, which deals *exclusively* with the materials problems of product design and manufacture.

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for simple and improved close tolerance scale removal

LIQUAMATTE *wet blasting...*

Fourteen advanced design features incorporated in the new Liquamatte make removal of light heat treat scale and surface cleaning easier and less costly. Its simplified design overcomes the many operating difficulties often found in wet blasting.

The Liquamatte has an exclusive vertical pump for slurry recirculation and agitation that overcomes packing leakage, shaft wear and plugging troubles. Ample clearance under the machine makes "good housekeeping" easy. Push button controlled — no valves to operate. The lightweight gun is easily maneuverable and throws a steady stream of slurry from any angle.

Applications in the heat treat field are many and varied making the Liquamatte a profitable cleaning room machine. Scale is completely removed from precision parts while holding tolerance as close as .0001". "Hand" finishes are produced mechanically in a matter of seconds.

Send today for bulletin No. 23 or ask for a demonstration.

American LIQUAMATTE WET BLASTING
WHEELABRATOR & EQUIPMENT CORP.
855 S. Byrkit St., Mishawaka, Ind.

Manufacturers' Literature . . .

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

INSPECTION SAMPLING MONITOR

A new four-page, two-color bulletin on the continuous sampling monitor – a new device to simplify quality control—has been announced as available from the General Electric Company, Schenectady 5, New York.

The booklet (GEA-5738) contains photographs and diagrams of the equipment and explains the continuous sampling monitor's operation, construction and range.

PREPARED GAS ATMOSPHERES

A new illustrated bulletin SC-155 on industrial applications of gas chemistry for heat treating has just been released by Surface Combustion Corporation, Toledo, Ohio.

Exothermic and endothermic type atmosphere generators are described and the gas generation processes schematically diagrammed. Compositions of each gas atmosphere and the respective heat treat process applications are described. In addition, notable examples of furnace design applications for continuous or batch production controlled atmosphere heat treating are presented.

The gas constituents, generator capacities, application data and operating costs for all of the prepared gas atmospheres are tabulated for handy reference in selecting atmospheres.

ABSENTEEISM

Absenteeism costs the employers on the average $56.00 per employee per year for every employee on the payroll, according to a report of A Survey on the Cost of Absenteeism which was conducted by Benson Laboratories, Inc. of Pittsburgh, Penna.

This survey, the first of its kind, covered 249 representative companies and revealed several significant facts.

Printed reports (8 page folder) of the result of this survey are available from Benson Laboratories Inc., Bessemer Building, Pittsburgh, Pennsylvania.

TOOLING UP FOR PLASTICS

The Carpenter Steel Company, Reading, Pa., just published a new 40-page book entitled "Tooling Up For Plastics", a practical guide for the selection, application and heat treatment of Carpenter Steel for plastic molding. The book presents practical answers to a large variety of questions on the subject, gives good details of proper heat treatment practice for various types of mold steels and contains useful weight and conversion tables.

RESISTANCE THERMOMETERS

The entire line of general-purpose and specialized Thermohms (resistance thermometers) that are being used in countless plant and laboratory applications to detect temperatures between −325 and +1000 F with accuracies from ±0.018 F to ±3.0 F are fully described and illustrated in a new, 36-page catalog and buyer's guide, "Thermohms, Assemblies, Parts and Accessories", just published by the Leeds & Northrup Company, Philadelphia, 44.

Included in the catalog are photographs and the complete specifications for every available Thermohm —from the well-known copper, nickel, and laboratory platinum types to the latest industrial platinum type. For the reader's convenience, accessories and replacement parts are grouped with the related Thermohms. And specifications are presented in tables so that the reader can easily compare Thermohms of the same type.

HEAT TREATING PLANT CONSTRUCTION AND EQUIPMENT SERVICE

Continental Industrial Engineers, Inc., Chicago, have published a new 12-page Booklet No. 127, which gives complete details of their industrial and heat treating plant design, construction and equipment service. The booklet illustrates a number of interesting heat treating plants and their facilities, as designed and produced by the company.

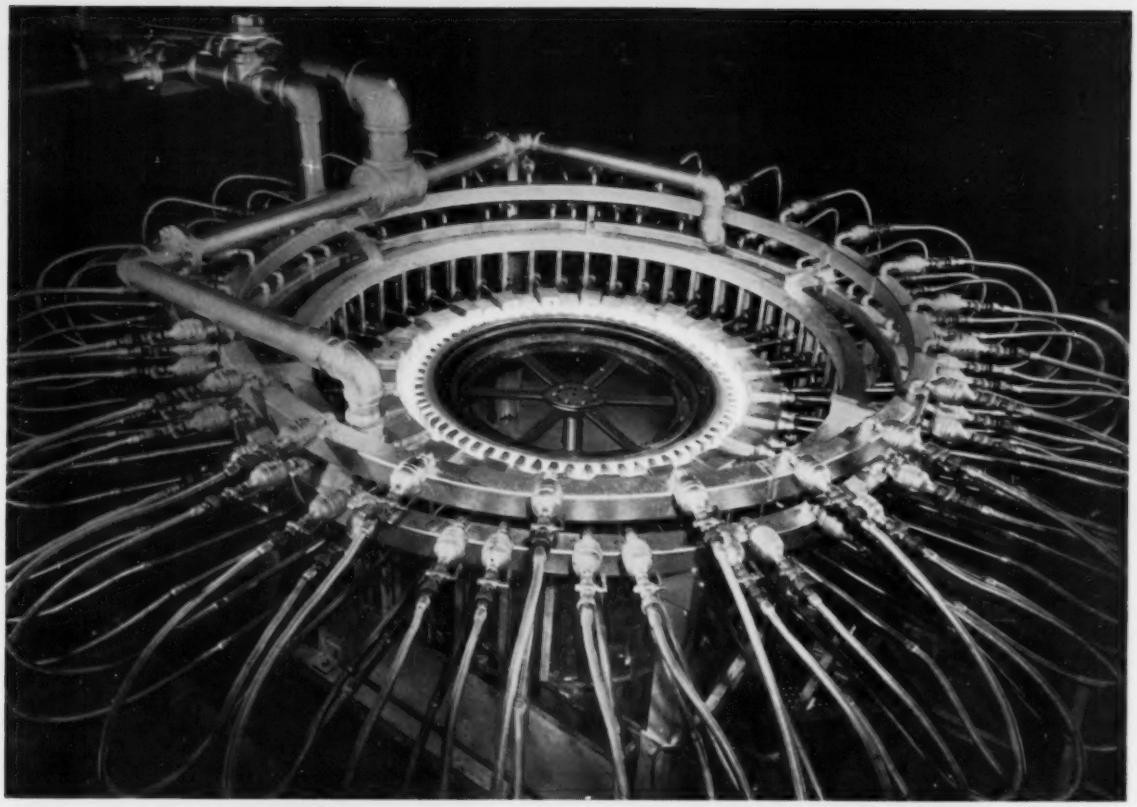
METAL CONVEYOR BELTS

Ashworth Bros. Inc., Worcester 4, Mass., has just published a very complete and well prepared 44-page catalog on the subject of Metal Conveyor Belts, working data for design, application and selection. The section devoted to heat treating contains numerous excellent illustrations showing and describing the type of metal conveyor belts which have proved most suitable for certain jobs in service.

INSTRUMENT TRANSFORMER BUYER'S GUIDE

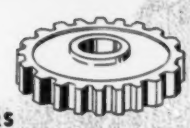
The 1952 edition of the Instrument Transformer Buyer's Guide, containing basic, up-to-date information on the complete line of General Electric instrument transformers, has just been released by the company's Meter and Instrument Department.

The fully illustrated, 94-page publication, GEA-4626E, gives ratings, ASA accuracy classifications and prices of all G-E indoor and outdoor potential and current transformers, metering outfits and potential and current portable transformers. Listings of ratio and phase-angle tests, together with tables covering the mechanical and thermal limits of current transformers are also included.



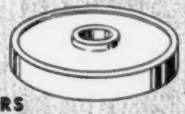
NEW possibilities for the manufacturer who needs

high hardness *without* critical alloys

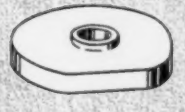


GEARS

SPROCKETS



ROLLERS



CAMS

Adaptable to all circular or nearly circular products up to 60 inches in diameter.

In the face of serious, continuing shortages of alloy steels—Wesley Steel Treating Company presents a practical alternative—a newly perfected process of flame heat treating which promises *normal alloy hardness,* using substitute steels currently available. This new Wesley process . . . which incorporates the latest and most advanced metallurgical knowledge, tempered by 35 years of practical heat treating experience . . . is now available for production heat treating of circular shapes up to 60 inches in diameter.

EXCEPTIONAL HARDNESS—Up to 50-plus Rockwell "C" face hardness can be obtained *in normal production* from plain medium (1045) carbon steel. Substantially higher hardness will result from use of lean alloys, including the new Boron and Titanium steels.

DEPENDABLE, UNIFORM RESULTS—Once the set-up is made, the entire cycle is automatically timed and controlled. Uniform heating is obtained by revolving the part in a continuous circle of focused flame. High velocity circulation of 850 GPM of quenching oil (or water) *directed at the heated surfaces* produces uniform, extremely rapid quenching—the key to high hardness with minimum distortion.

SELECTIVE HEAT TREATING—Use of normal flame temperatures permits *controlled* heat penetration which can be varied to produce a deep, hard crust which gradually tapers off to a soft inner core. In gear hardening, controlled penetration provides needed strength at the root of the tooth at the same time the wearing faces are hardened.

LOW COST—The entire face of the gear or other part is heat treated in a single operation, eliminating the costly hand work previously necessary. Use of lower grade, lower cost steels normally results in additional cost advantages of improved machinability and longer tool life.

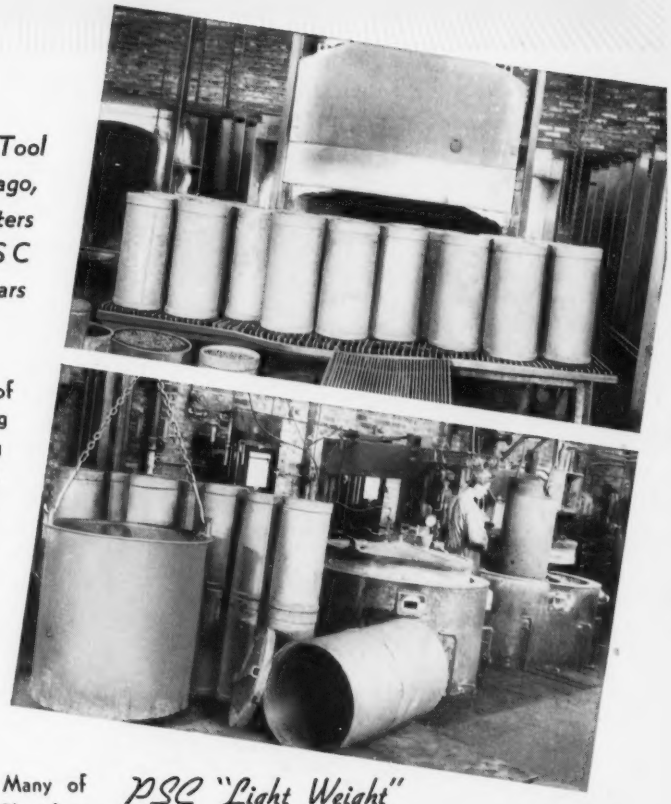
PHONE, WIRE OR WRITE for further information. If we can help you, we'll tell you how and to what extent. If we can't, we'll tell you that, too.

Wesley Steel Treating Co.

1321-1403 W. PIERCE ST., MILWAUKEE 4, WISCONSIN • PHONE Mitchell 5-8767

MANY VIP IN HEAT-TREAT FIELD HAVE USED PSC 'LIGHT-WEIGHT' EQUIPMENT FOR OVER 20 YEARS

Very Important People Are Perfection Tool and Metal Heat Treating Co. of Chicago, One of Largest Commercial Treaters in Nation. They Have Used PSC Containers Exclusively for Over 20 Years



Pictured at right are views in plant of Perfection Tool & Metal Heat Treating Co. of Chicago, showing PSC heat-treating containers in use. One of the foremost commercial heat-treaters in the country, Perfection has been employing PSC "Light-Weight" equipment exclusively since 1929, the year they placed their first order. Suggesting the many different types of containers and fixtures we supply Perfection, they use thirty different sizes of the carburizing boxes pictured at top.

Among the users of PSC heat-treating units are the majority of the metal-working firms in America today. Many of them have been users since the late 20's when this new light-weight, welded alloy equipment was introduced. PSC units furnished in any size, design or metal specification: annealing and carburizing boxes, fixtures, retorts, covers, etc. Send blue prints or write as to your needs.

PSC "Light Weight"

Heat-Treating Equipment for Any Product and Any Metal

Carburizing and Annealing Boxes
Baskets • Trays • Fixtures
Muffles • Retorts • Racks
Annealing Covers and Tubes
Pickling Equipment
Tumbling Barrels • Tanks
Cyanide and Lead Pots
Thermocouple Protection Tubes
Radiant Furnace Tubes and Parts
Heat, Corrosion Resistant Tubing

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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